

WHAT IS CLAIMED IS:

1. An isolated polynucleotide which encodes a polypeptide with sucrose synthase activity comprising a member selected from the group consisting of:
 - 5 (a) a polynucleotide having at least 80% sequence identity, as determined by the GAP algorithm under default parameters, to a polynucleotide of SEQ ID NO: 1 or SEQ ID NO: 11;
 - (b) a polynucleotide encoding a polypeptide of SEQ ID NO: 2 or SEQ ID NO: 12;
 - 10 (c) a polynucleotide amplified from *Zea mays* nucleic acids using primers which selectively hybridize, under stringent hybridization conditions, to loci within a polynucleotide of SEQ ID NO: 1 or SEQ ID NO: 11;
 - (d) a polynucleotide which selectively hybridizes, under stringent hybridization conditions and a wash in 0.1X SSC at about 65°C, to a polynucleotide of SEQ ID NO: 1 or SEQ ID NO: 11;
 - 15 (e) a polynucleotide of SEQ ID NO: 1 or SEQ ID NO: 11;
 - (f) a polynucleotide which is complementary to a polynucleotide of (a), (b), (c), or (e); and
 - (g) a polynucleotide comprising at least 50 contiguous nucleotides from a polynucleotide of (a), (b), (c), (d), (e), or (f).
- 20 2. A recombinant expression cassette, comprising a member of claim 1 operably linked, in sense or anti-sense orientation, to a promoter.
- 25 3. A host cell comprising the recombinant expression cassette of claim 2.
4. A transgenic plant comprising a recombinant expression cassette of claim 2.
- 30 5. The transgenic plant of claim 4, wherein said plant is a monocot.

6. The transgenic plant of claim 4, wherein said plant is a dicot.

7. The transgenic plant of claim 4, wherein said plant is selected from the group consisting of: maize, soybean, sunflower, sorghum, canola, wheat, alfalfa, 5 cotton, rice, barley, millet, peanut, and cocoa.

8. A seed from the transgenic plant of claim 4.

9. A method of modulating the level of sucrose synthase in a transgenic plant, 10 comprising:

- (a) introducing into a plant cell a recombinant expression cassette comprising a polynucleotide of claim 1, operably linked to a promoter;
- (b) culturing the plant cell under plant cell growing conditions;
- (c) regenerating said transgenic plant; and
- (d) expressing said polynucleotide, which results in production of an encoded 15 protein, for a time sufficient to modulate the level of sucrose synthase in said plant.

10. The method of claim 9, wherein said plant is selected from the group 20 consisting of: maize, soybean, sunflower, sorghum, canola, wheat, alfalfa, cotton, rice, barley, millet, peanut, and cocoa.

11. The method of claim 9, wherein the encoded protein comprises a member selected from the group consisting of:

- 25 (a) a polypeptide of SEQ ID NO: 2 or SEQ ID NO: 12;
- (b) a polypeptide having at least 80% identity to, and having at least one epitope in common with, a polypeptide of SEQ ID NO: 2 or SEQ ID NO: 12, wherein said sequence identity is determined using the GAP algorithm under default parameters; and
- 30 (c) at least one polypeptide encoded by a member of claim 1.

12. An isolated protein comprising a member selected from the group consisting of:

- (a) a polypeptide of SEQ ID NO: 2 or SEQ ID NO: 12;
- (b) a polypeptide having at least 80% sequence identity to, and having at least 5 one epitope in common with, a polypeptide of SEQ ID NO: 2 or SEQ ID NO: 12, wherein said sequence identity is determined by the GAP algorithm under default parameters; and,
- (c) at least one polypeptide encoded by a member of claim 1.

10 13. A method of increasing cellulose production in the stalk tissue of a transgenic plant, comprising:

- (a) introducing into a plant cell a recombinant expression cassette comprising a sucrose synthase polynucleotide operably linked to a promoter;
- (b) culturing the plant cell under plant cell growing conditions;
- 15 (c) regenerating said transgenic plant; and
- (d) expressing said polynucleotide for a time sufficient to increase the level of sucrose synthase in said plant.

14. The method of claim 13, wherein said plant is selected from the group 20 consisting of: maize, soybean, sunflower, sorghum, canola, wheat, alfalfa, cotton, rice, barley, millet, peanut, and cocoa.

25 15. The method of claim 13, wherein said sucrose synthase polynucleotide is Sus1, Sh1, or Sus3 from maize.

16. The method of claim 13, wherein said promoter preferentially directs expression in stalk tissue.

30 17. A method of increasing the concentration of cellulose in the tissues of a seed of a transgenic plant, comprising:

- (a) introducing into a plant cell a recombinant expression cassette comprising

- a sucrose synthase polynucleotide operably linked to a promoter;
- (b) culturing the plant cell under plant cell growing conditions;
- (c) regenerating said transgenic plant; and
- (d) expressing said polynucleotide for a time sufficient to increase the level of sucrose synthase in said seed of said transgenic plant.

18. The method of claim 17, wherein said plant is selected from the group consisting of: maize, soybean, sunflower, sorghum, canola, wheat, alfalfa, cotton, rice, barley, millet, peanut, and cocoa.

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19. The method of claim 17, wherein said sucrose synthase polynucleotide is Sus1, Sh1, or Sus3 from maize.

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20. The method of claim 17, wherein said promoter preferentially directs expression in the seed.

21. The method of claim 17, wherein said promoter preferentially directs expression in the pericarp.